Datasheet for the decision
of 23 January 2009

Case Number: T 1846/06 - 3.4.02
Application Number: 96307360.6
Publication Number: 0836083
IPC: G01J 3/453
Language of the proceedings: EN
Title of invention: Digitisation of interferograms in fourier transform spectroscopy
Patentee: PERKIN-ELMER LIMITED
Opponent: Datrex AG
Headword: -
Relevant legal provisions: EPC Art. 123(2)
Relevant legal provisions (EPC 1973): EPC Art. 56
Keyword: "Late-filed document" "Remittal"
Decisions cited: -
Catchword: -
Case Number: T 1846/06 - 3.4.02

DECISION
of the Technical Board of Appeal 3.4.02
of 23 January 2009

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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted 5 October 2006 concerning maintenance of
European patent No. 0836083 in amended form.

Composition of the Board:
Chairman: A. Klein
Members: F. Maaswinkel
B. Müller
Summary of Facts and Submissions

I. The opponent lodged an appeal, received on 9 December 2006, against the interlocutory decision of the opposition division, dispatched on 5 October 2006, on the amended form in which the European patent No. 0 836 083 (application No. 96307360.6) could be maintained. The fee for the appeal was paid on 6 December 2006. The statement setting out the grounds of appeal was received on 9 February 2007.

The patent proprietor likewise lodged an appeal, received on 12 December 2006, against this interlocutory decision. The appeal fee was paid the same day. The statement setting out the grounds of appeal was received on 14 February 2007.

II. The opposition had been filed against the patent as a whole on the basis of Article 100(a) EPC and had been substantiated by the grounds that the subject-matter of the patent was not patentable within the terms of Articles 52(1), 54 and 56 EPC 1973.

The opposition division decided that the subject-matter of claim 1 of the patent as granted did not involve an inventive step but that the patent in amended form according to the proprietor's auxiliary request met the requirements of the EPC, having regard inter alia to the following documents:

III. Since both parties had requested oral proceedings they were summoned in a Communication by the Board of Appeal of 4 November 2008 to oral proceedings scheduled to take place on 23 January 2009.

IV. In a letter sent on 22 January 2009, i.e. the day before the scheduled oral proceedings, and received by facsimile in the afternoon the appellant/opponent submitted a new document:


According to the appellant/opponent this document was prima facie highly relevant because it was highly likely to prejudice the maintenance of the patent, therefore it should be admitted in the proceedings.

V. At the oral proceedings the appellant/patent proprietor (in the following: "proprietor") requested that the patent be maintained as maintained by the opposition division in the decision under appeal. It dropped its original request that the part of the decision under appeal, in which the opposition division refused to
allow its main request, be set aside and that the patent be maintained on the basis of that main request.

The appellant/opponent (in the following: opponent) requested that the decision under appeal be set aside and that the European patent be revoked, furthermore, as an auxiliary request, that the case be remitted to the first instance for further consideration of document P7.

VI. The wording of claim 1 of the proprietor's single request reads as follows:

"1. Apparatus for processing the output signals of a Michelson type interferometer used in Fourier Transform spectroscopy, which outputs include a waveform comprising an interferogram and a waveform representing reference interference fringes, said apparatus comprising an analogue-to-digital converter (12) for providing a digital representation of the interferogram waveform, means (15) for providing a fixed frequency clock signal to said analogue-to-digital converter and processing means (18) arranged to receive the digital representation of the interferogram waveform and a digital representation of the reference fringe waveform and to process said inputs to provide a digital output representing the interferogram, characterised in that

the waveform representing the reference fringes is applied to an input of a second fixed frequency analogue-to-digital converter (14) to produce the digital representation of said waveform, and said processing means (18) is arranged to interpolate the digital representation of the reference fringes and to
determine the time at which each reference fringe is at a predetermined datum point, and to interpolate the digital representation of the interferogram and determine the value of the interferogram at the datum points".

Claims 2 to 11 are dependent claims.

VII. The arguments of the opponent may be summarised as follows.

*Added subject matter*

Amended claim 1 includes the new features:

(i) "said processing means is arranged to interpolate the digital representation of the reference fringes and to determine the time at which each reference fringe is at a predetermined datum point"; and

(ii) "to interpolate the digital representation of the interferogram and determine the value of the interferogram at the datum point".

The appealed decision states that the basis for these amendments is in col. 6, l. 9 to 17 of the published (A1) patent application and furthermore in original claims 5, 8 and original Figure 5 and the corresponding description. It was acknowledged by the Opposition Division that this basis refers to specific embodiments. However, the only disclosure in the original application disclosing the "two step process" in present claim 1 (i.e. features (i) and (ii)) may be found in col. 6, l. 13 to 20. The patentee has limited the claims to this embodiment. In order to find support for the more generic features of "datum points", the Opposition Division referred to col. 2, l. 50 to 58 of the A1-publication and to claims 5 and 8. However, that
disclosure is not directed to the embodiment based on the "two step process". Because there is no disclosure of such two step process with any datum point different from the zero crossing, the features (i) and (ii) do not comply with Article 123(2) EPC. Furthermore, in view of the feature directed to the "ΔΣ converter" the Opposition Division has stated that the ΔΣ converter is only disclosed "by way of example". This view is not correct, since a ΔΣ converter is a necessary part of the embodiment disclosed on top of col. 6. The fixed frequency analogue-to-digital (AD) converter is one of the key features of the claims as maintained. While there is some general disclosure that a ΔΣ converter is not the only possibility for a converter in the general teaching of the patent, there is no disclosure whatsoever that different converters could be used in the context of the embodiment on which the "two step process" is based. Obviously, the converter disclosed in l. 1 to 20 of col. 6 is in close functional relationship with the features directed to treatment of data provided by the converter. The features disclosed in this paragraph thus have a clear technical interrelationship. Introduction of features i) and ii) into claim 1 without limitation of claim 1 to a ΔΣ modulator thus also contravenes Article 123 EPC.

**Patentability**

Document P4 is considered as the closest prior art because it discloses most of the structural features of claim 1. P4 discloses an apparatus for processing the output signals of a Michelson type interferometer used in Fourier Transform spectroscopy. Its outputs include a waveform comprising an interferogram and a waveform representing reference interference fringes, see
Figure 3. The apparatus comprises an AD converter for providing a digital representation of the interferogram (ADC in Figure 3 positioned between the Pre-amp and the DSP) and means for providing a fixed frequency clock signal to the ADC (see page 1346, rhc, l. 5-7). Processing means are arranged to receive the digital representation of the interferogram waveform (DSP board and PC 486-50 in Figure 3) and a digital representation of the reference fringe waveform (PC 486-50). As acknowledged by the Opposition Division, the only difference between document P4 and the invention as defined in claim 1 is that P4 does not specifically recite a means to interpolate the digital representations of the interference fringes and the interferogram. The technical effect of this difference is to enable the device to be used for continuous scanning interferometry. Thus, the objective technical problem faced by the skilled person is to modify the interferometer of P4 for the possibility of continuous scanning interferometry. The particular interferometer in P4 is used for step-scan spectroscopy but this apparatus is based on a modified continuous scan interferometer which can be indeed used for continuous scan interferometry, as is also practiced in document P5. The only modification necessary for using the device of P4 as a continuous scanning interferometer is to provide means for determination of the zero crossings when the mirror of the interferometer is continuously moving. The obvious way for determination of these points in time is interpolation of the digitised reference signal. The skilled person would realise that once the reference fringes have been digitised by the second ADC, the system could effectively be utilised for continuous scanning.
interferometry. Therefore, the step of interpolation is simply the direct consequence of using a digitized reference signal and thus cannot make claim 1 inventive. Accordingly, it is submitted that the subject matter of claim 1 of the patent lacks an inventive step.

Alternatively, document P1 can also be considered as the closest prior art because this document has the greatest functional similarity to the claimed invention. P1 discloses a continuous-scanning Fourier Transform spectrometer. Its outputs include a waveform comprising an interferogram (p. 2891, col. 1, l. 19-21) and a waveform representing reference interference fringes (p. 2892, col. 1, l. 8). The apparatus has an AD converter for providing a digital representation of the interferogram waveform (see Figure 7 showing a 20 bit AD converter). The apparatus further has means for providing a fixed frequency clock signal to said AD converter (p. 2896, col. 1, l. 19-22, 40 MHz crystal dock). Processing means (PC, Fig. 7) are arranged to receive the digital representation of the interferogram waveform and of the reference fringe waveform. The processing means are further arranged to process said inputs to provide a digital output representing the interferogram (PC). Furthermore, P1 discloses a method of interpolating a digital representation of the interferogram in order to determine the value of the interferogram at desired points (Fig. 4). The apparatus disclosed in P1 only differs from the apparatus of amended claim 1 in that it lacks a second fixed frequency AD converter to provide a digital representation of the reference fringes, instead utilising discriminators, and that P1 does not specifically recite a means to interpolate the digital
representation of the reference fringes. Since a
discriminator/counter involves analogue components
which are noise-sensitive and cost-expensive the
technical problem addressed by claim 1 is the provision
of an interferometer having an increased quality and
reduced fabrication costs. Since the apparatus of P1
already includes a fixed frequency AD converter (for
the processing of the interferogram) and in this
document the advantages of such a component are
discussed, it would be obvious for the skilled person
to also employ such an AD converter for the
digitization of the laser fringes. In this case,
interpolation of the fringe data is simply a direct
consequence of the digitization process. Therefore
claim 1 lacks an inventive step over the disclosure of
P1 alone. Furthermore also in P4 an AD converter for
digitization of the reference fringes is utilised.
Claim 1 therefore also lacks an inventive step over P1
in combination with P4.

Document P7 was found through a reference in the only
very recently published US patent application
US2008/198374. This patent application relates to the
same technical field as the contested patent. The new
evidence P7 is referred to in paragraph [0015] of this
US publication, where the time-sampling techniques of
P7 are compared to those described in US-A-5,914,780,
which document is a family member of the contested
patent. In the opponent's opinion this document P7 is
highly relevant since it relates to continuous scan
interferometry wherein both the interferogram data and
the reference fringes are digitised, thereby
anticipating the subject-matter of claim 1. In
accordance with the case law (T 1002/92) it should therefore be admitted into the proceedings.

VIII. The arguments of the proprietor may be summarised as follows.

The opponent has argued that claim 1 has been amended in a way which offends Article 123 EPC. According to the opponent claim 1 has been limited to a specific embodiment. This is not correct: in claim 1 features have been introduced which are described with reference to an embodiment but this is not to say that the claims have been restricted to that embodiment. It was furthermore objected that the claim should be restricted to zero crossings and not the more general term datum points. This is quite clearly incorrect. The originally filed specification (see col. 2, l. 57 to col. 3, l. 3 of the A1 publication) makes it perfectly clear that the datum points may be some or all of the zero crossing points or intermediate points and this statement is not restricted to any particular embodiment. It is quite clearly applicable to any embodiment of the invention. A similar argument can be made in relation to the $\Delta\Sigma$ converter. The skilled person readily appreciates from the passage in col. 3, l. 4 and 5 of the A1 publication that the preferred converter is a $\Delta\Sigma$ modulator but this statement clearly envisages the use of other AD converters and again this statement is made in general terms without reference to a specific embodiment. It is totally unjustified to suggest that claim 1 of the upheld auxiliary request should be restricted to a $\Delta\Sigma$ converter.
As to the issue of patentability, the opponent has argued that claim 1 lacks an inventive step over the disclosure of document P1. In support of this contention an "objective problem" is formulated which, in the proprietor's view, is a hindsight analysis of the problem in the knowledge of the invention defined in claim 1. There is nothing in the prior art to show that the so called defects of P1 had been appreciated by workers in the field. The so called objective problem of providing an interferogram having an increased quality of the signal and reduced fabrication costs is a generally expressed problem and of course applied to the developers of the arrangement described in document P1. The developers of the arrangement disclosed in document P1 followed what was the logical route to take by providing a discriminator in the reference signal path as described on p. 2892, rhc, l. 1 to 6 and shown in Figure 1 of P1. It is a hindsight analysis to say that the discriminator can easily be replaced by an AD converter and this can be shown by the fact that the author of document P1 had the opportunity of using an AD converter in the reference signal channel because such was available in the AD converter which he used, that AD converter having two channels. If it was such an obvious step to take then the authors of document P1 would have taken that step. The authors of P1 had clearly not recognised the benefits which could arise from using a second AD converter in the reference channel. The proprietor therefore submits that the opponent's arguments regarding P1 are not valid. It was also argued that there is a lack of inventive step over the disclosure of document P4. As the opponent has recognised P4 discloses a step-scan Fourier Transform spectrometer. A
step-scan spectrometer as can be seen by many of the submissions made in relation to these proceedings is distinct from a continuous scanning spectrometer with which the present invention is concerned. The argument which the opponent presents is that all that the patent proprietor had to do in the light of document P4 was to modify that interferometer for the possibility of continuous scanning. This is quite clearly a fallacious argument because the signals produced by the AD converters in the arrangement of document P4 are used to control the position at which the mirror is held fixed during a measurement of the step-scan spectrometer and where the Fast Fourier Transform is carried out entirely within the Digital Signal Processing Board DSP, see page 1347, ll, line 7. A person skilled in the art would recognise that this is not equivalent to the way in which the reference signal is used in a continuous scan arrangement where the reference signal is used to identify where at any instant the scan of the spectrometer has reached. This is in no way equivalent to the AD converter signals of the step-scan arrangement shown in document P4.

With respect to the newly filed document P7 the opponent has argued that it is prima facie highly relevant. It is conceded that it may be possibly more relevant than all other documents in the proceedings. However, this document was only received in the afternoon before the oral Proceedings. Hence, for reasons of procedural fairness the patent proprietor should be given an opportunity to have its position duly prepared. Therefore, should this document be admitted into the proceedings it is requested to have its contents considered at two levels. The proprietor
would therefore agree with remittal of the case to the opposition division.

Reasons for the Decision

1. The opponent's appeal is admissible. The proprietor, in the oral proceedings, dropped its original request and requested that the patent be maintained as maintained by the opposition division in the decision under appeal. This means that the proprietor no longer wished to pursue its appeal, which is therefore considered withdrawn.

2. Amendments

2.1 During the opposition proceedings claim 1 has been amended to include the new features labelled in point 3.1.1 of the Decision as "features (i) and (ii)" which correspond to the same features as in Section VII supra. According to the opposition division, support for these features is in col. 6, l. 9 - 17 and also in the diagram in original Figure 5 and the corresponding part of the description in col. 7, l. 3 - 17 of the published patent application.

2.2 The opponent has objected that the support in col. 6 concerns the specific embodiment of Figure 2 and that, according to this passage in col. 6, the particular ΔΣ AD converter is used (col. 6, l. 1), furthermore, that the interpolation of the reference fringes is carried out to determine the time at the zero crossing of the fringes (col. 6, l. 9 - 15). Therefore, introduction of the features (i) and (ii) in the claim without the
simultaneous restriction of the AD converter to a ΔΣ converter and the interpolation at a general "datum point" instead of the disclosed "zero crossing points" was objectionable.

2.3 The proprietor has argued that the skilled person appreciates from the original patent application that these features "ΔΣ converter" and "interpolation at zero crossings" are in no way essential for the invention.

2.4 With respect to the feature ΔΣ converter the proprietor referred to col. 3, l. 4 and 5 of the published patent application, according to which "The analogue-to-digital converter is preferably a delta-sigma modulator". Furthermore the opposition division had mentioned the phrase in col. 2, l. 23, which reads "an analogue-to-digital converter such as a delta sigma (ΔΣ) modulator...". As to the passage in col. 6 concerning the specific embodiment in Figure 2 and referred to by the opponent it is noted that the relevant disclosure of this embodiment starts in line 56 of col. 5. Here it is disclosed that "By way of introduction it is assumed that the ADC's 12 and 14 are constructed by a dual channel delta sigma (ΔΣ) converter which has two analogue inputs and synchronously samples each input (i.e. the interferogram and the reference fringe signal) at a fixed frequency of 48 kHz". In the opinion of the Board this passage, together with the earlier passages, confirms that, while the skilled person learns from the disclosure that it may be quite advantageous to select a ΔΣ converter as AD converter, this is not an essential feature of the invention.
2.5 With respect to the feature "datum points" the Board shares the position of the Opposition Division in point 3.1.3 of the Decision that the passage in col. 2, l. 57 to col. 3, l. 3 clearly discloses that the interferogram is reconstructed at "datum points" which "may be some or all of the zero crossing points of the reference fringes. Alternatively, the datum points may be points intermediate the zero crossing points of the reference fringes".

2.6 The Board agrees with the opponent that the passage in col. 6 of the published patent application does not mention such generalisations. However, in a typical patent application document it is not unusual that in the introductory part possible general alternatives are indicated with which the invention would work, furthermore that "preferred" or "even more preferred possibilities" are listed, and that in the further part of the disclosure a more detailed and very specific example of the invention is given. Clearly, in providing detailed information in such a specific example the applicant will usually not repeat all possible alternatives, because they do not occur in this specific example and their explicit listing in this example is therefore not necessary.

2.7 Hence, if such an example or embodiment is used as a basis for amendments it is to be examined whether it is evident from the disclosure as a whole that the claimed invention, including such amendments, could only work with the specific features of the very example or that the skilled person would understand from the disclosure as a whole that the features in the example were only listed in order to better understand or re-do the
invention. In the present case the Board is convinced that the originally filed patent application provides ample support for the position that the features "ΔΣ converter" and "zero crossing", although possibly preferred as in the example of Figure 2, are not essential and that the skilled person would be aware of alternatives, the more so as such alternatives are indicated in the disclosure. Hence the amendments are not objectionable under Article 123(2) EPC.

3. Patentability

3.1 The novelty of the subject-matter of present claim 1 was not disputed.

3.2 Inventive step

3.2.1 For its objections of lack of inventive step the opponent has referred to documents P4 and P1 as the closest prior art.

3.2.2 According to the opponent, document P4 may be considered as the closest prior art, because the interferometer apparatus disclosed in P4 shows most of the structural features defined in claim 1. It is true that in the problem and solution approach one of the criteria for the closest prior art document is that its disclosure has the most relevant technical features in common, i.e. requiring the minimum of structural modifications. However, the further and perhaps more decisive criterion for the closest prior art document is that it should disclose subject-matter conceived for the same purpose or aiming at the same objective as the claimed invention. By the latter condition it is
avoided that a document disclosing an accidentally structurally similar apparatus is selected as closest prior art. In this respect document P4 appears less suitable, because, although relating to a Michelson type interferometer, it discloses a "step-scanning interferometer" in which one of the mirrors is "stepped" and held at discrete positions. This is in contrast to a "continuous scanning" type Michelson interferometer, in which the moving mirror is continuously moved and which position is recorded by a reference fringe signal simultaneously with the interferogram signal, see the illustration in Figure 3 of the patent specification. As pointed out in point 3.2.3 of the Decision under appeal, P4 discloses that the reference fringes are used "to determine the position of the moving mirror by converting the two laser signals to a unique position within one He-Ne fringe. This position serves to give feedback to the controller of microstepper motor. In other terms, the only use of the digitized reference fringes in P4 is as part of the feedback loop which controls the position of the mirror".

3.2.3 The opponent had argued that the only difference between the step-scanning interferometer of P4 and the invention as defined in claim 1 was that P4 did not disclose a means to interpolate the reference fringes and that the underlying technical effect was to enable that interferometer to be used for continuous scanning. This determined also the objective technical problem, namely to modify the step-scanning interferometer of P4 for an application in continuous-scanning interferometry.
3.2.4 The Board does not concur with this argument. When considering the contents of document P4 in its entirety it is observed that the starting point of the development of that step-scanning interferometer was to avoid the need of lock-in amplifiers used previously and of which examples are shown in Figure 1 (for single-modulation) and in Figure 2 (for double-modulation measurements). The apparatus shown in Figure 3 aims at overcoming the prior problems with lock-in amplifiers and relies on the combination of a microstepper motor and a piezoelectric transducer (PZT), the position of which is controlled by a feedback loop including two He-Ne lasers and associated controllers (ADC's, a PC and a DAC and HV amplifier). Since the He-Ne fringe data are only used within this feedback loop (see point 3.2.2 supra) there is no need in that apparatus for any further "interpolation" of the fringe data. Furthermore, as pointed out by the proprietor, in the step-scanning apparatus of Figure 3 of P4 the calculation of the FFT is carried out within the DSP board. Therefore, to modify that step-scanning interferometer for continuous-scanning use would probably require a rather major, if not complete, redesign of the apparatus.

3.2.5 The opponent has also considered document P1 as closest prior art. Indeed this document relates to a continuous-scanning interferometer, i.e. the type of interferometer providing an interferogram waveform and reference interference fringes as in claim 1. According to the opponent (and also discussed in point 3.2.2 of the appealed Decision) the apparatus of claim 1 differs from the prior art device in that the digital representation of the reference fringes is applied to
an input of a second fixed frequency analogue-to-digital converter to produce the digital representation of its waveform and subsequent interpolation, whereas in the device of P1 a discriminator is used (Figures 1 and 7). Since a discriminator includes analogue components which are noise sensitive and costly the technical problem should be seen in improving the prior art interferometer. Furthermore, since the apparatus of P1 already included a fixed-frequency AD converter (for the treatment of the interferogram data, see Figure 7) the skilled person would be prompted to replace the discriminators by such AD converters.

3.2.6 In point 3.2.2 of the Decision the Opposition Division had observed that document P1 addresses two basic issues of continuous scanning Fourier transform spectroscopy, namely: when to sample and how to sample. As a solution of the problem "when to sample" P1 offers to include a "discriminator" or a "simple interval timer gated by the fringe crossings" (Figure 1 and p. 2892, rhc). According to the Opposition Division, the main part of P1 deals with the issue how to sample and offers a new procedure with an improved precision including an adaptive digital filter. Therefore the skilled person did not get any information from the disclosure of P1 to question the suitability of a discriminator for defining the point in time when to sample.

3.2.7 The Board finds the arguments of the Opposition Division persuasive. In particular it accepts the further argument that the author of this document P1, while using already an analogue-to-digital converter (for processing the interferogram signal), chose the
"simple interval timer" for solving the "when to sample" issue. Since this author may be considered a technical specialist in this technical field the reader of average skill would have had no obvious reason to modify that apparatus. Furthermore, as also mentioned by the Opposition Division, an exchange of the discriminator of P1 by an analogue-to-digital converter would not mean a simple exchange of two hardware parts, but presumably include a redesign of processing routines and corresponding software.

3.2.8 It is therefore concluded that the subject-matter of claim 1 is not obtainable in an obvious way from a combination of the teachings of the documents relied upon by the opponent during the first instance opposition procedure.

3.3 Document P7

3.3.1 This document had been submitted by the opponent in the afternoon before the Oral Proceedings (see point IV supra). Making reference to decision T 1002/92 the opponent argued that this document was prima facie highly relevant because it was highly likely to prejudice the maintenance of the patent in question and that this document should therefore be admitted into the proceedings.

3.3.2 On the one hand, as set out in the previous points of the present Decision, the documents available to the Opposition Division do not prejudice the maintenance of the patent. On the other hand, without going more into the merits of document P7, the proprietor has conceded that this document might be highly relevant. It is
therefore concluded that the evidence forming the basis of the appeal proceedings has substantially changed.

3.3.3 In its auxiliary request the opponent requested that the case be remitted to the first instance for further consideration of document P7, and the proprietor did not object to this course of action.

3.3.4 In the light of the above the Board concludes that it is appropriate to remit the case to the first instance in accordance with Article 111(2) EPC 1973 for the assessment of patentability of the claimed subject-matter taking due account of document P7.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance for further prosecution.

The Registrar: The Chairman:

M. Kiehl A. G. Klein